

CLAIMS

What is claimed is:

1. A fluid purification system for purifying a fluid comprising:
 - a substrate;
 - a photocatalytic coating applied on said substrate; and
 - a light source to activate said photocatalytic coating, said light source including a non-reflective portion that allows passage of light and a reflective portion that reflects said light to pass through said non-reflective portion of said light source.
2. The fluid purification system as recited in claim 1 wherein said light source activates said photocatalytic coating, and said photocatalytic coating oxidizes contaminants that are adsorbed onto said photocatalytic coating when activated by said light source.
3. The fluid purification system as recited in claim 1 wherein said light source is an ultraviolet light source.
4. The fluid purification system as recited in claim 3 wherein said light source is a mercury vapor lamp.
5. The fluid purification system as recited in claim 3 wherein said light source is an excimer lamp.
6. The fluid purification system as recited in claim 3 wherein said light source is an electrodeless lamp.
7. The fluid purification system as recited in claim 3 wherein said light source is an inductively coupled lamp.

8. The fluid purification system as recited in claim 3 wherein said light source is a radio frequency powered lamp.
9. The fluid purification system as recited in claim 3 wherein said light source is a light emitting diode.
10. The fluid purification system as recited in claim 3 wherein said light source generates said light having a wavelength between 180 nm and 400 nm.
11. The fluid purification system as recited in claim 10 wherein said light source has a peak wavelength of 254 nm.
12. The fluid purification system as recited in claim 1 wherein said photocatalytic coating is titanium oxide.
13. The fluid purification system as recited in claim 1 wherein photons from said light source are absorbed by said photocatalytic coating to form a reactive hydroxyl radical that oxidizes contaminants in the presence of oxygen and water to water and carbon dioxide.
14. The fluid purification system as recited in claim 1 wherein said contaminants are a volatile organic compound including at least one of formaldehyde, toluene, propanal, butene, acetaldehyde, aldehyde, ketone, alcohol, aromatic, alkene, and alkane.
15. The fluid purification system as recited in claim 1 wherein said contaminants are a semi-volatile organic compound including at least one of naphthalene, PCB, PAH and an insecticide.

16. The fluid purification system as recited in claim 1 wherein said reflective portion cover a portion of said light source.
17. The fluid purification system as recited in claim 16 wherein said reflective portion covers more than half of said portion of said light source.
18. The fluid purification system as recited in claim 1 wherein said non-reflective portion of said lamp is proximate to said substrate and said reflective portion of said light source is distal to said substrate.
19. The fluid purification system as recited in claim 1 wherein said substrate is an array of voids separated by a solid.
20. The fluid purification system as recited in claim 1 further including a housing, the fluid purification system is in said housing, and walls of said housing are lined with a reflective material.
21. The fluid purification system as recited in claim 1 wherein said light source is cylindrical.
22. The fluid purification system as recited in claim 1 wherein said reflective portion is a reflective coating.
23. The fluid purification system as recited in claim 1 wherein said non-reflective portion of said light source is shaped to direct said light to said substrate.
24. The fluid purification system as recited in claim 1 wherein said reflective portion of said light source is shaped to direct said light to said substrate.

25. The fluid purification system as recited in claim 24 wherein said non-reflective portion of said light source is shaped to direct said light to said substrate.
26. The fluid purification system as recited in claim 24 wherein said non-reflective portion of said light source is a converging lens.
27. The fluid purification system as recited in claim 1 wherein said non-reflective portion of said light source is a converging lens.
28. The fluid purification system as recited in claim 1 wherein the fluid is air.
29. The fluid purification system as recited in claim 1 wherein said substrate is porous and allows a fluid to flow through said substrate.
30. The fluid purification system as recited in claim 1 wherein said light source directs said light towards said substrate and directs said light away from an undesired location.

31. A fluid purification system for purifying a fluid comprising:
 - a substrate;
 - a photocatalytic coating applied on said substrate; and
 - a light source to activate said photocatalytic coating, said light source including a non-reflective portion that allows passage of light and a reflective portion that reflects said light to pass through said non-reflective portion and towards said substrate, and said reflective portion reflects said light away from an undesired location.

32. A germicidal system for destroying an undesired entity comprising:
the undesired biological entity; and
a light source including a non-reflective portion that allows passage of light and a reflective portion that reflects said light to pass through said non-reflective portion and towards the undesired entity.
33. The germicidal system as recited in claim 32 wherein the undesired biological entity is one of bacteria, fungi, mold and viruses.
34. The germicidal system as recited in claim 32 wherein the undesired biological entity is suspended in a fluid.
35. The germicidal system as recited in claim 34 wherein said fluid is air.
36. The germicidal system as recited in claim 34 wherein said fluid is in motion.
37. The germicidal system as recited in claim 34 wherein said fluid is stationary.
38. The germicidal system as recited in claim 32 further including a surface and the biological entity is on said surface.
39. The germicidal system as recited in claim 38 further including a photocatalytic coating applied on said surface, and said light source activates said photocatalytic coating.
40. The germicidal system as recited in claim 38 wherein said surface is a food preparation surface.
41. The germicidal system as recited in claim 38 wherein said surface is a fluid filter.

42. The germicidal system as recited in claim 38 wherein said surface is a medical surface.
43. The germicidal system as recited in claim 38 wherein said surface is in motion.

44. A material purification system comprising:
 - a substrate;
 - a light source to increase a chemical reaction rate of a material on said substrate, said light source including a non-reflective portion that allows passage of light and a reflective portion that reflects said light to pass through said non-reflective portion of said light source.
45. The system as recited in claim 44 wherein said material is in a fluid.
46. The system as recited in claim 45 wherein said fluid is air.
47. The system as recited in claim 45 wherein said material is suspended in said fluid.
48. The system as recited in claim 45 wherein said fluid is in motion.
49. The system as recited in claim 45 wherein said fluid is stationary.
50. The system as recited in claim 44 wherein said substrate transmits said light.
51. The system as recited in claim 44 wherein said substrate displays information.
52. The system as recited in claim 44 wherein said material is ozone.
53. The system as recited in claim 44 wherein said substrate is porous.

54. A fluid purification system for purifying a fluid comprising:
a container having an inlet and an outlet;
a porous substrate inside said container;
a device for drawing a fluid into said container through said inlet, flowing said fluid through said porous substrate, and expelling said fluid out of said container through said outlet;
a photocatalytic coating applied on said substrate; and
an ultraviolet light source to activate said photocatalytic coating, and photons from said ultraviolet light source are absorbed by said photocatalytic coating to form a reactive hydroxyl radical, and said reactive hydroxyl radical oxidizes contaminants in said fluid that are adsorbed onto said photocatalytic coating when activated by said light ultraviolet light source to water and carbon dioxide in the presence of water and oxygen, and said ultraviolet light source includes an non-reflective portion that allows passage of light and a reflective portion that reflects said light to pass through said non-reflective portion of said light source.

55. A method of purifying a fluid comprising the steps of:
providing a light source having an non-reflective portion and a reflective portion
that covers at least half of a cross-sectional surface area of said light source;
generating light that passes through said non-reflective portion of said light source
and that reflects on said reflective portion of said light source and passes through said
non-reflective portion of said light source; and
absorbing said light on a photocatalytic surface.